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**Alkaloid Studies
of Acceptable and
Discount Varieties of
Flue-Cured Tobacco
Grown in 1957**

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ABSTRACT

Acceptable and discount varieties of flue-cured tobacco are characterized on the basis of their alkaloid content and nitrogen to alkaloid ratio. Over 7200 green-leaf, and 6900 cured-leaf, flue-cured tobacco samples from all sections of the flue-cured growing area were analyzed for alkaloid content, and nitrogen was determined in more than 2000 samples.

The alkaloid levels and nitrogen to alkaloid ratios of acceptable and discount varieties are compared for each growing area both for green-leaf test plot and farm samples, and for cured-leaf farm and redrying plant samples. The data are presented by State and county, by type, and for most of the cured-leaf samples, by grade.

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ALKALOID STUDIES
OF ACCEPTABLE AND DISCOUNT VARIETIES
OF FLUE-CURED TOBACCO GROWN IN 1957

by

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INTRODUCTION

A 1954 survey conducted in one of the States producing flue-cured tobacco showed that more than 70 varieties of flue-cured tobacco were being grown. The growth of such a large number of varieties is probably desirable since no one variety has been found to have the exact combination of qualities that will satisfy all growers, manufacturers, and consumers. Thus, undesirable qualities of some varieties may be counter-balanced by desirable qualities of other varieties and the overall effect on the industry leads to a certain stability.

Several dry years in succession, combined with changes in cultural conditions, resulted in stronger, higher nicotine tobacco being produced and brought a demand from industry for milder tobaccos. Three varieties, Coker 139, Coker 140, and Dixie Bright 244, were produced by tobacco breeders and were expected at the time of their introduction to be the salvation of the industry. These varieties proved to be highly acceptable to the farmer because they were milder,

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were lower in nicotine, possessed acceptable disease resistance, had curing qualities which resulted in relatively higher Federal Grades, and gave high yields compared with standard varieties.

The 3 new varieties proved to be so popular with the farmers that approximately 70 percent of the 1956 crop was estimated to consist of them. However, the new varieties proved to be "low to lacking in flavor and aroma, generally of light body, and. . . . [poorly accepted in] the trade." In addition, the disproportionate amount of these varieties led to an unbalance in the various quality factors available to buyers. They also were especially undesirable to the foreign consumers, and it soon became obvious that something must be done to place the industry on a sounder basis.

After extensive consultation with the various segments of the industry, the United States Department of Agriculture on December 18, 1956, announced plans to reduce the 1957 crop support rates for the varieties Coker 139, Coker 140, and Dixie Bright 244 to 50 percent of the support rates for comparable grades of the other "acceptable" flue-cured varieties. The three varieties were thus made "discount varieties." The Department also announced plans for enforcement of the price-support discount program.

Basically, the program consisted of variety identification prior to the marketing of the crop and issuance of a readily distinguishable marketing card to those growers who had grown one or more of the discount varieties. The success of this procedure depended largely on the positive identification of the discounted varieties in the field prior to the harvesting and marketing of each farmer's crop.

The three discount varieties were known to have distinguishable physical characteristics and in studies made by the North Carolina State Agricultural Experiment Station they had been found to have a much lower nicotine content when compared with standard varieties under all conditions studied. A study made of all chemical data available indicated that the nicotine to total nitrogen ratio might also be of use in identifying the varieties.

The identification procedure evolved depended on visual identification of the varieties in the field by specialists trained to identify the varieties by distinguishable agronomic

characteristics. When the specialists found a field containing plants with physical characteristics of one of the discount varieties they took samples and sent them to the laboratory for chemical analysis. In addition to these samples taken for variety identification, many samples were taken from known acceptable and discount varieties in test plots maintained by both Experiment Stations and Agricultural Stabilization Committees throughout the flue-cured area.

This report will be concerned primarily with the data obtained on samples collected from various test plots in the flue-cured belt and their comparison on an aggregate basis with samples taken by the teams of variety identification specialists.

Sampling Procedures of Program and Research Analyses

The sampling procedure and equipment used were based on modifications of procedures developed at the Kentucky Agricultural Experiment Station for studies of the genetics of alkaloid production (Griffith, unpublished). The basic procedure used involved taking a disk with a No. 10 cork borer from a leaf at a point next to the midrib and between two large lateral veins located just beyond the center of the leaf toward the tip. Extensive data obtained at the Kentucky station had shown that a sample of 10 such disks taken from this location on 10 leaves would give, after drying, an analytical value within $\pm 2\%$ of the value that would be obtained if the 10 leaves were oven-dried, the midrib removed, and the web portion ground and analyzed.

In the work herein reported green leaf samples were taken when possible from leaves located near the middle of representative plants approaching maturity. The disks were taken next to the midrib and between two large lateral veins located just beyond the center of the leaf toward the tip, by placing the curved surface of a sponge rubber ball beneath the leaf where the disk was to be taken. The cork borer was then placed in position; when it was rotated with a slight pressure the leaf plug was removed. When a sample consisting of one disk from each of 10 to 15 representative plants had been collected, it was transferred to a previously numbered No. 1 coin envelope by blowing sharply on the handle end of the cork borer.

In taking the farm samples a minimum of 4 samples was taken per farm or 2 samples per field if the farm had

more than one field of tobacco. The fields were sampled by walking diagonally across them, disks from representative plants being collected at random. Replicate samples were taken by walking in different directions. Where apparent varietal mixtures were encountered in a single field, comparative samples of the acceptable and discount varieties (hereafter designated as A V and D V) were taken from representative plants located in the same part of the field. In those cases where a farmer was believed to have a uniform planting of a discount variety, comparative acceptable variety samples were obtained from adjacent farms.

Test plot samples usually, were taken from 10 to 15 plants located in a single row in the same manner as described above.

The envelopes used were coded with a six-digit number indicating the State in which the sample was taken, the team taking the sample, and the particular sample number. The envelopes were numbered before they were issued; it was therefore impossible to have duplicate numbers. At the time of sampling, this number was entered on a record sheet which showed farm serial number, county, community, and other related information or identified the test plot and variety. The record sheet was sent to a central office in Raleigh, N.C. The envelopes containing the individual samples were placed in large manila envelopes and were air-mailed to the laboratory in Lexington, Ky.

In addition to the green leaf samples (composed of disks) some cured samples were taken for analysis. For this, a sample hand consisting of 30 to 40 leaves of fourth priming tobacco was formed by selecting individual leaves at random from a crop. The sample hand was sent to Raleigh, where a 1-inch strip was cut from the widest part of the leaves with a heavy-duty papercutter. The "strip" sample of the 30 to 40 cured leaves was then placed in an appropriately numbered paper bag and mailed to the laboratory.

Analytical Methods

Samples were normally received in the laboratory of the Kentucky station within 24 hours after they were mailed. When received, the green disk samples were given a laboratory number; they were then placed in an oven maintained at 65° C. After drying overnight the samples were weighed and

returned to the envelope. The disks were placed directly into the still and analyzed for total alkaloids by the procedure described by Griffith ["The Rapid Determination of Total Alkaloids by Steam Distillation," Tobacco Science 1: 130-137 (1957)].

Cured samples were numbered and placed in a forced draft oven maintained at 65° C. overnight. The midrib was removed from the oven-dried samples before they were ground in an intermediate Wiley mill to pass a 40-mesh screen. After thorough mixing in a pint ice-cream carton on a rotary mixer, the samples were placed in 1-ounce salve boxes which were labeled with the laboratory number. The samples were analyzed immediately for total alkaloids by the Griffith procedure.

In most cases total nitrogen determinations were also made on the cured samples and on some of the disk samples which were taken for this purpose. The method of sample collection and preparation were the same as those already described. The samples were analyzed by either of the two following methods, which seemed to be equally satisfactory.

- I. A 0.5-gram sample of tobacco was placed in an 800 ml Kjeldahl flask. Ten grams of a salt mixture consisting of 2,000 gm of Na_2SO_4 , 150 gm of CuSO_4 , and 20 gm of powdered selenium metal were added along with 25 ml of concentrated sulfuric acid. The flask was turned frequently during a 15 minute period of digestion at low heat. The heat was then increased and digestion was allowed to proceed for an additional 30 minutes. After cooling, 300 ml of tapwater was added and the mixture was shaken until all salt was dissolved. A few grams of zinc metal (30-mesh) and 75 ml of 40 percent sodium hydroxide were added. Approximately 200 ml of distillate were collected in a flask containing 28 ml of boric acid solution containing indicator and the resulting solution was titrated with standard hydrochloric acid.
- II. In the alternate method a 1.0-gm sample was used. Twenty gm of potassium sulfate, 0.6 gm of mercuric oxide, and 30 ml of concentrated sulfuric acid were added. The digestion and distillation were conducted as in the first procedure.

All laboratory data for each sample were recorded on a single sheet of paper. When the analyses were complete, the data were copied by means of a duplicating machine. The copy was sent to the central Raleigh office to be matched with the records made at the time the samples were taken. Since the laboratory did not receive any information about the sample except its number, the data obtained as a basis for variety identification could not be affected by any bias. Without exception alkaloid data were airmailed to the Raleigh office the day after the samples were received. This usually meant that the analytical data were received in Raleigh about 96 hours after the samples were taken.

Evaluation of the Method

Plans for the identification program were not crystallized until the crop was well advanced in Florida; initial studies of the proposed methods were made on tobacco furnished through the courtesy of Fred Clark of the Florida Agricultural Experiment Station. Several varieties were sampled, each from a high-fertility plot and from a low-fertility plot, on June 12, 1957. Rainfall had been excessive on this tobacco during growth. The high-fertility plot was sampled in accordance with the above-described procedures (10 to 15 plants) while the low-fertility plot was sampled by taking 10 to 15 disks each from the leaves of several individual plants, averages being calculated on a variety basis. The results are given in Table 1.

Table 1. Effects of 2 fertility levels on percent alkaloids in green leaves of certain varieties of flue-cured tobacco grown at the Florida Agricultural Experiment Station, Gainesville, 1957.

Variety	Percent* Total Alkaloids	
	High Fertility	Low Fertility
Hicks	1.57	0.76
Yellow Special A	1.55	--
Vg 2	1.51	.52
402	1.49	.72
Golden Cure	1.36	.54
Coker 187	1.36	--
Average	1.47	0.62
Dixie Bright 244	1.12	0.43
Coker 139	.92	.41
Coker 140	.48	.27
Average	0.84	0.37

* 65° C. "dry" basis.

Although the differences between varieties were not as large as expected, without exception the discount varieties were found to be lower in total alkaloids (nicotine) when grown under the same fertility conditions, whether high or low. It should be noted, however, that Dixie Bright 244 and Coker 139 contained more total alkaloids when grown under the high-fertility level than did the standard varieties grown with a lower fertility level.

The 4th priming from these same plots was cured by Dr. Clark and the samples were analyzed with the results given in Table 2.

Table 2. Effects of fertility levels on percent alkaloids, percent nitrogen, and nitrogen-alkaloid ratio in cured leaves of the 4th priming of certain varieties of flue-cured tobacco grown at the Florida Agricultural Experiment Station, Gainesville, 1957.

Variety	High Fertility Level			Low Fertility Level		
	Alkaloids*	Nitrogen*	Ratio	Alkaloids*	Nitrogen*	Ratio
	%	%		%	%	
Yellow Special A	2.10	2.88	1.37	--	--	--
Hicks	1.67	2.62	1.57	1.01	1.66	1.64
402	1.89	2.38	1.26	.83	1.36	1.64
Coker 187	1.89	2.42	1.28	--	--	--
Golden Cure	1.39	2.54	1.82	.86	1.40	1.63
Average	1.99	2.57	1.46	0.90	1.47	1.64
Dixie Bright 244	1.16	2.50	2.16	0.51	1.06	2.08
Coker 139	1.14	2.36	2.07	.56	1.24	2.22
Coker 140	.72	2.10	2.92	.46	1.56	3.39
Average	1.01	2.32	2.38	0.51	1.29	2.56

* 65° C. "dry" basis.

Total nitrogen was run on these cured samples and the total nitrogen to total alkaloid ratios were calculated. Expressed on this basis the discount varieties could be easily distinguished from the standard varieties regardless of fertility level. These data indicate the desirability of both nitrogen and total alkaloid values in identifying the discount varieties when exactly comparable samples are not available.

As could be expected the fertility level had a definite effect on the alkaloid and nitrogen levels, both being much higher where the fertility level was higher. The total nitrogen to total alkaloid ratios, however, were relative constant

for a variety regardless of fertility level. In comparing the results obtained on the green and cured samples, one should remember that the same leaves were not represented by the two sampling procedures and that the results are therefore not exactly comparable. Despite this difference, the results are of the same order of magnitude. There are some indications that the results obtained on the basis of the two methods of sampling may be dependent upon the particular variety and that the alkaloid level may change in the different manners.

A similar variety test, which involved the duplicate sampling of green leaves from each of 14 varieties, was conducted at the Georgia Coastal Plain Experiment Station, through the courtesy of John G. Gaines. The results are given in Table 3. Cured samples were also taken from the second and fourth primings of eight of these varieties and were analyzed with the results shown in Table 4. In general, the results were higher than those obtained in Florida, but again the results obtained for the discount varieties were

Table 3. Percent alkaloids in duplicate samples taken June 25, 1957, from varieties grown with a fertility application of 1,600 pounds of 3-9-9 per acre, at the Georgia Coastal Plain Experiment Station, Tifton.

Variety	Percent Alkaloids*		
	Replicate 1	Replicate 2	Average
Oxford 1-181	3.11	2.40	2.76
Yellow Mammoth	2.73	2.59	2.66
Golden Harvest	2.45	2.37	2.41
Yellow Special A	2.20	2.33	2.27
Hicks	1.96	2.32	2.14
402	2.16	1.96	2.06
Virginia 2	1.89	1.95	1.92
Coker 187	1.97	1.84	1.91
Dixie Bright 101	1.87	1.84	1.86
Golden Cure	1.58	1.70	1.64
Speight 42	1.34	1.49	1.42
Average	2.11	2.07	2.10
Coker 139	1.29	1.30	1.30
Dixie Bright 244	1.00	1.03	1.02
Coker 140	.95	1.00	.98
Average	1.08	1.11	1.10

* 65° C. "dry" basis.

Table 4. Percent alkaloids, percent nitrogen, and nitrogen alkaloid ratio in cured leaves of tobacco 2nd and 4th primings of certain varieties of flue-cured tobacco grown at the Georgia Coastal Plain Experiment Station, Tifton, 1957.
(All data on 65° C. "dry" basis)

Variety	Avg. Green		4th Priming			2nd Priming		
	Percent Alkaloids	Percent Alkaloids	Percent Alkaloids	Percent Nitrogen	Ratio	Percent Alkaloids	Percent Nitrogen	Ratio
Yellow Mammoth	2.66		3.11	1.84	0.59	1.52	1.70	1.12
Hicks	2.14		2.59	1.66	.64	1.50	1.72	1.15
Golden Harvest	2.41		2.53	1.92	.76	2.04	2.28	1.12
402	2.06		2.40	1.62	.68	1.48	1.98	1.34
Golden Cure	1.64		1.56	1.66	1.06	1.07	1.74	1.63
Average	2.18		2.44	1.69	0.72	1.52	1.90	1.25
Dixie Bright 244	1.02		1.55	1.70	1.10	1.28	2.10	1.61
Coker 140	.98		1.11	1.68	1.51	.69	2.12	3.07
Coker 139	1.30		.68	1.50	2.21	1.08	1.92	1.78
Average	1.10		1.11	1.69	1.52	1.02	2.05	2.00

lower than those obtained on standard varieties. The agreement between replicates in Table 3 is similar to that obtained in other work throughout the summer and is given as a measure of the reproducibility of the method. The duplicate would seem to be satisfactory except for Oxford 1-181.

The percent alkaloids obtained on the cured samples are compared in Table 4 with the results obtained for the green samples. In general, the green-sample analyses compared more closely with those of the 4th priming than they did with those of the 2nd priming, probably because the two groups of samples were from similar leaves. The discount varieties could be distinguished from the acceptable varieties except for Golden Cure, on the basis of the total alkaloid content or the total nitrogen to total alkaloid ratio. This difficulty was not apparent in the green sample analysis of percent alkaloids. In general, the acceptable varieties showed more difference between the two primings than the discount varieties.

In another test experiment, plots of Coker 139 fertilized with differing levels of nitrogen were also sampled at Tifton, and the results (Table 5) were obtained. The alkaloids level was found to increase with increasing levels of nitrogen for topped and untopped plants. The difference in level of alkaloids between the topped and untopped plants for a given nitrogen level was less than one might expect on the basis of previous work with standard varieties.

Table 5. Effect of nitrogen fertilization on the percent alkaloids of green leaves of Coker 139 grown at the Georgia Coastal Plain Experiment Station, Tifton, 1957.

(30 plants sampled per treatment)

Nitrogen	Percent* Alkaloids	
	Untopped Plants	Topped Plants
51	1.02	1.30
84	1.17	1.58
117	1.46	1.72

* 65° C. "dry" basis.

To compare the variation in total alkaloid content of leaves in the middle of the stalk versus that of leaves at the top of the same plant, 1200 plants were sampled at the

North Carolina Agricultural Experiment Station (Oxford Res. Sta., Oxford). These results on an A V - D V basis are present in Table 6. The top leaves of A V tobacco contained approximately 1 percent less alkaloids than middle leaves, but they still contained more alkaloids than the D V tobacco regardless of positions.

Table 6. Effect of stalk position on the alkaloid content of green leaves of flue-cured tobacco grown at Oxford, N.C., 1957.
(1200 plants sampled)

Stalk Position	Percent* Alkaloids	
	A V	D V
Middle leaves	3.87	2.23
Top leaves	2.88	1.20

* 65° C. "dry" basis.

At the Border Belt Tobacco Research Station, Whiteville, North Carolina, increasing the nitrogen fertilization of the 3 discount varieties from 40 to 60 pounds increased the total alkaloid content of the green leaves (Table 7).

Table 7. Effect of nitrogen fertilization on the alkaloid content of green leaves of D V flue-cured tobacco at Whiteville, N. C., 1957.

(30 plants sampled per treatment)

Variety	Percent* Alkaloids	
	40 lb. N	60 lb. N
Coker 140	1.00	1.63
Coker 139	1.16	2.04
Dixie Bright 244	1.04	1.54

* 65° C. "dry" basis.

The county Agricultural Stabilization Committees in many tobacco producing counties maintained test plots of varieties commonly grown in that particular area. Tobacco from these plots was sampled.

A summary of the results of ASC and experiment station plot analyses is presented in Table 8. A total of 1,101 samples of known variety were analyzed. The three discount

varieties had a weighted average total alkaloid percent of 1.17 as compared to 2.27 for the other varieties. This gave a difference of 1.10 percent and a D V/A V ratio of 0.52. The Virginia D V/A V ratio is greater than that for other areas. A possible explanation may be the small number of samples involved as well as the variation in size and maturity of plants at sampling.

Of the total number of test plots, a higher percentage were located in North Carolina, where a wide range of weather and other environmental factors were prevalent. The analytical data from the North Carolina plots are shown in Table 9. These data show that the 3 discount varieties at 48 locations had a lower average total alkaloid content than any of the other listed varieties. In most cases, a condition that will affect one variety will usually affect other varieties in a similar manner. This was shown by the uniformity of the relative rankings based on total alkaloids for the different varieties grown in the various locations.

RESULTS OF VARIETY-IDENTIFICATION SPECIALIST CLASSIFICATION

The variety-identification specialists were instructed to take a minimum of 4 samples per farm, or 2 samples per field if the farm had more than 1 field of tobacco having growth characteristics of a discount variety. A final tabulation (Table 10) of farms visited and samples taken shows that the green samples per farm averaged 4.26 samples of D V and 1.92 samples of A V; the cured samples per farm averaged 0.96 D V and 0.91 A V samples.

The variety-identification specialists in the 5 States obtained a total of 6,190 farm samples (Table 11); discount variety samples totaled 4,272 and acceptable variety samples totaled 1,918. The average percent total alkaloids for the D V samples was 1.90 compared to 3.09 for the A V samples, with a difference of 1.19 percent and a D V/A V ratio of 0.62. These results compare favorably with the results from the test-plot plants sampled earlier in the season (Table 8) which had an A V - D V difference of 1.10 percent and a D V/A V ratio of 0.52.

The complete data by States and counties are shown in Tables 12 through 16. A comparison of percent total alka-

Table 8. Total alkaloid values for flue-cured tobacco from ASC and Experiment Station test plots, by States - mature green leaf analysis.

State	Total Number Samples	Number Samples		Percent* Alkaloids		$\frac{D V}{A V}$ Ratio	Difference in % Alkaloids of A V - D V
		D V	A V	D V	A V		
Florida	260	90	170	0.60	1.12	0.54	0.52
Georgia	40	18	22	1.10	2.09	.53	.99
South Carolina	125	33	92	.85	1.55	.55	.70
North Carolina	648	187	461	1.48	2.82	.52	1.34
Virginia	28	9	19	1.91	2.79	.68	.88
Totals	1,101	337	764	--	--	--	--
Weighted Averages	--	--	--	1.17	2.27	0.52	1.10

* 65° C. "dry" basis.

Table 9. Average alkaloid percent of certain varieties of flue-cured tobacco at different locations in North Carolina, 1957-mature green leaf analysis

Variety	Number of Plantings	Average Percent* Alkaloids
Oxford 1-181	30	2.99
Buyer's Choice	18	2.98
711	23	2.85
402	17	2.82
Hicks	44	2.74
Bottom Special	24	2.66
Coker 187	40	2.64
Virginia 21	18	2.53
White Gold	25	2.48
Dixie Bright 101	23	2.32
Dixie Bright 244	48	1.72
Coker 139	48	1.44
Coker 140	48	1.24

* 65° C. "dry" basis.

Table 10. Average number of samples per flue-cured tobacco farm by kind and type of sample, 1957 farm crop of 5 States.

State	Kind of Sample	Number of Farms Sampled	Number of Samples	Number of Samples		Average Number Samples Per Farm	
				D V	A V	D V	A V
Florida	Green	27	102	51	51	1.89	1.89
	Cured	0	0	0	0	--	--
Georgia	Green	11	59	45	14	4.09	1.27
	Cured	7	7	7	0	1.00	--
S. Carolina	Green	89	546	364	182	4.09	2.05
	Cured	22	39	24	15	1.09	.68
N. Carolina	Green	792	4,667	3,338	1,329	4.22	1.68
	Cured	530	975	499	476	.94	.90
Virginia	Green	83	816	474	342	5.71	4.12
	Cured	34	88	39	49	1.14	1.44
All	Green	1,002	6,190	4,272	1,918	4.26	1.92
	Cured	593	1,109	569	540	.96	.91

loids, percent total nitrogen, and ratios of the two for cured farm samples from the five States is shown in Table 17. A total of 569 D V cured samples, with an average total alkaloid percentage of 2.10, average total nitrogen of 1.95 percent, and a ratio of 0.93, were taken as compared with 540 A V cured samples that had an average total alkaloid percent of 3.04, average total nitrogen percent of 2.05, and a ratio of 0.67.

Tables 18 and 19 show the grand totals for farm and experimental mature green leaf and cured samples. A total of 7,291 green samples and 1,364 cured samples were analyzed. The A V - D V difference in percent total alkaloids for green samples was 1.17 and cured 0.91 percent. The A V - D V difference in percent total nitrogen was 0.35 for green samples and 0.10 for cured samples. Wet weather conditions in Florida were reflected in the low alkaloid content of the samples from both experimental plots and producer farms.

Table 11. Variety-identification specialist classification of green-leaf flue-cured tobacco and actual percent alkaloids, 1957 farm crop of 5 States.

State	Number of Samples	Number of Samples		Average Percent* Alkaloids		$\frac{D}{A} \frac{V}{V}$ Ratio	Diff.
		D V	A V	D V	A V		
Florida	102	51	51	0.75	1.60	0.47	0.85
Georgia	59	45	14	1.09	1.74	.63	.65
S. Carolina	546	364	182	1.34	2.69	.50	1.35
N. Carolina	4,667	3,338	1,329	1.94	3.13	.62	1.19
Virginia	816	474	342	2.25	3.44	.65	1.19
Total	6,190	4,272	1,918	--	--	--	--
Weighted Averages	--	--	--	1.90	3.09	0.62	1.19

* 65° C. "dry" basis.

Table 12. Comparison of variety-identification specialist classification of green-leaf flue-cured tobacco and percent alkaloids, 1957 Florida farm crop.

County	Farms Sampled	Number of Samples	Number of Samples		Average Percent* Alkaloids		$\frac{D}{A} \frac{V}{V}$ Ratio
			D V	A V	D V	A V	
Columbia	13	46	23	23	0.62	1.18	0.53
Jefferson	13	54	27	27	.87	1.98	.44
Madison	1	2	1	1	.66	.91	.73
Total	27	102	51	51	--	--	--
Weighted Averages	--	--	--	--	0.75	1.60	0.47

* 65° C. "dry" basis.

Table 20 presents the test plot classification and analysis of green flue-cured tobacco by types (Belts). The comparisons of variety identification specialists classification by types is shown in Table 21. These results show the influences due to area as well as climatological influences for a single year. The results are in agreement with the conclusion that the nitrogen content of the leaves varies with area and environment less than does the nicotine content.

Table 13. Comparison of variety-identification specialist classification of flue-cured tobacco and percent alkaloids, nitrogen, and ratio of nitrogen to alkaloids, 1957 Georgia farm crop.

County and Kind of Sample	Number of Farms Sampled	Number of Samples	Number of Samples		Average Percent* Alkaloids		Average Percent* Nitrogen		Ratio		Ratio N / Alkaloids	
			D	V	D	V	D	V	D	V	D	V
Berrien: Green Cured	1	4	4	0	1.33	1.00	--	--	--	--	--	--
Brooks: Green Cured	2	0	0	0	--	.94	--	--	1.54	--	1.54	--
Cook: Green Cured	2	8	8	0	1.32	.92	--	--	1.49	--	1.58	--
Dodge: Green Cured	1	8	4	4	1.14	1.14	--	--	1.32	--	1.44	--
Laurens: Green Cured	1	12	8	4	.43	--	0.68	--	1.58	--	1.38	--
Lowndes: Green Cured	1	10	10	0	1.16	--	.38	--	--	--	--	--
Pierce: Green Cured	1	5	5	0	1.75	1.21	--	--	--	--	--	--
Tift: Green Cured	1	8	4	4	.99	--	.44	--	1.22	--	1.08	--
Wheeler: Green Cured	1	4	2	2	.66	1.79	.38	--	--	--	--	--
Total & Average: Green Cured	11	59	45	14	1.09	1.74	.63	--	1.43	--	1.38	--

* 65° C. "dry" basis.

Table 14. Comparison of variety-identification specialist classification of flue-cured tobacco and percent alkaloids, nitrogen, and ratio of nitrogen to alkaloids, 1957 South Carolina farm crop.

County and Kind of Samples	Number of Farms Sampled	Number of Samples	Number of Samples		Percent* Alkaloids	Average		D V Ratio	Percent* Nitrogen		Ratio	
			D V	A V		D V	A V		D V	A V	D V	A V
Chesterfield: Green Cured	20	130	7	6	1.62	2.64	0.61	0.61	--	--	--	--
Clarendon: Green Cured	185	1189	80	38	1.28	2.57	.50	.50	1.71	1.88	1.12	0.71
Darlington: Green Cured	175	917	53	38	1.50	2.86	.52	.64	2.66	2.24	1.77	.78
Dillon: Green Cured	62	553	38	17	1.16	2.59	.45	--	1.68	2.07	.95	.73
Dorchester: Green Cured	30	140	6	8	.97	1.31	.74	--	1.63	--	1.45	--
Florence: Green Cured	246	14013	89	51	1.34	2.72	.49	.85	1.77	1.68	1.09	.87
Horry: Green Cured	21	221	16	6	1.74	2.04	.85	--	1.69	--	1.28	--
Lee: Green Cured	02	010	0	4	1.68	2.88	.58	--	--	--	--	--
Marion: Green Cured	51	382	26	12	1.57	3.12	.50	.71	2.65	--	1.67	.84
Williamsburg: Green Cured	102	454	43	2	1.13	2.32	.57	.58	1.63	1.64	1.22	.71
Total & Average: Green Cured	8922	54639	364	182	1.34	2.67	.50	.66	2.33	2.24	1.74	.84
			24	15	1.59	2.41	.66	--	1.71	1.84	1.08	.76

* 65° C. "dry" basis

Table 15. Comparison of variety-identification specialist classification of flue-cured tobacco and percent alkaloids, nitrogen, and ratio of nitrogen to alkaloids, 1957 North Carolina farm crop.

County and Kind of Samples	Number of Farms Sampled	Number of Samples	Number of Samples		Average Percent*		Ratio		Average Percent*		Ratio		N/Alkaloids	
			D	V	D	V	D	V	D	V	D	V	D	V
Alamance:														
Green Cured	8	25	17	8	1.45	3.37	0.43							
	18	22	14	8	2.15	2.94	.73							
Beaufort:														
Green Cured	12	63	61	2	2.51	4.24	.59		1.98	2.19			0.92	0.74
	4	18	18	0	2.46	--	--							
Bertie:														
Green Cured	18	100	93	7	2.07	3.57	.59		2.09	--			.84	--
	13	18	8	10	1.99	3.21	.62							
Bladen:														
Green Cured	10	78	67	11	1.39	2.44	.57		2.93	2.06			1.41	.64
	4	5	4	1	1.88	2.26	.70		1.74				.87	
Brunswick:														
Green Cured	1	8	4	4	.88	1.57	.56		2.53	1.78			1.80	.70
	1	2	1	1	2.81	3.67	.77		2.03	1.83			1.28	.80
Caswell:														
Green Cured	12	57	43	14	2.43	4.00	.61		1.95	1.98			.69	.53
	12	18	4	14	1.75	3.82	.46							
Chatham:														
Green Cured	3	24	20	4	1.52	1.98	.77		1.84	2.42			1.05	.63
	3	3	1	2	1.73	1.90	.91							
Chowan:														
Green Cured	3	9	6	3	1.95	2.81	.69		2.02	1.79			1.17	.94
	0	0	0	0	--	--	--							
Columbus:														
Green Cured	4	24	14	10	1.37	2.01	.68							
	4	7	1	6	.86	1.79	.37							
Craven:														
Green Cured	10	82	59	23	2.10	3.78	.55		1.36	1.47			2.00	.83
	10	63	51	12	2.07	3.38	.61		2.04	2.31			.99	.68

(Continued)

County and Kind of Samples	Number of Farms Sampled	Number of Samples		Number of Samples		Average Percent*			D V Ratio	Average Percent*			D V Ratio	N/Alkaloids			Ratio D V
		Samples	A V	D V	A V	Alkaloids		Nitrogen		Nitrogen		N/Alkaloids					
						D V	A V			D V	A V	D V		A V	D V	A V	
Cumberland:																	
Green Cured	10	40	40	00	00	1.42	--	--	--	--	--	--	--	--	--	--	
Davidson:																	
Green Cured	96	656	580	70	60	1.72	2.48	0.69	--	--	--	--	--	--	--	--	
Duplin:																	
Green Cured	10359	63394	46255	17139	2.012.51	1.521.81	--	.76	1.82	1.82	--	1.82	1.82	1.00	0.72	--	
Durham:																	
Green Cured	53	243	140	103	3.003.95	2.08--	--	.69	--	--	--	2.44	--	--	--	--	
Edgecombe:																	
Green Cured	137	718	523	195	3.423.38	2.802.85	--	.82	2.772.73	2.042.29	--	--	--	.98	.59	.62	
Forsyth:																	
Green Cured	105	1085	831	254	3.143.72	2.051.50	--	.65	1.53	2.38	--	--	--	1.02	.64	.68	
Franklin:																	
Green Cured	64	4816	373	1113	3.132.67	1.991.88	--	.64	1.82	1.99	--	--	--	.97	.74	--	
Granville:																	
Green Cured	1211	4324	338	1016	4.203.17	2.832.72	--	.67	2.07	1.92	--	--	--	.80	.60	--	
Greene:																	
Green Cured	248	20426	9910	10516	3.414.67	1.851.75	--	.54	1.63	2.06	--	--	--	.93	.44	--	
Guilford:																	
Green Cured	1712	4812	4110	72	2.303.50	1.641.99	--	.71	1.85	2.28	--	--	--	.93	.65	--	
Halifax																	
Green Cured	54	2814	149	145	4.593.40	2.042.87	--	.44	1.88	1.92	--	--	--	.66	.56	--	

County and Kind of Samples	Number of Farms Sampled	Number of Samples	Number of Samples		Average Percent*		D V A V Ratio	Average Percent*		D V A V Ratio	N/Alkaloids	
			D V	A V	Alkaloids	A V		Nitrogen	A V			
						D V			A V		D V	A V
Harnett:												
Green Cured	27	149	79	70	2.39	3.49	0.68	2.18	2.08	0.88	0.71	
	18	33	11	22	2.48	2.90	.86					
Hertford:												
Green Cured	2	4	4	0	2.30	2.80	--	--	2.28	--	.81	
	1	2	0	2	--	--	--					
Hoke:												
Green Cured	1	7	0	7	--	3.05	--	--	--	--	--	
	0	0	0	0	--	--	--					
Johnston:												
Green Cured	65	421	185	236	1.66	3.39	.49	1.76	2.02	1.02	.69	
	54	131	71	60	1.72	2.91	.59					
Jones:												
Green Cured	14	105	82	23	1.83	3.09	.59	1.76	2.09	.93	.73	
	8	29	21	8	1.89	2.86	.66					
Lee:												
Green Cured	3	21	12	9	1.83	3.35	.55	2.16	2.77	.79	.52	
	3	3	2	1	2.73	5.30	.51					
Lenoir:												
Green Cured	48	196	101	95	1.74	2.33	.74	1.73	2.15	.91	.68	
	19	24	10	14	1.90	3.12	.61					
Martin:												
Green Cured	27	115	79	36	2.30	3.95	.59	2.21	2.07	.96	.60	
	19	20	3	17	2.29	3.40	.67	2.02		.88		
Nash:												
Green Cured	7	32	22	10	2.63	3.71	.71	1.61	2.20	.90	.74	
	7	7	3	4	1.79	2.98	.60					
Northampton:												
Green Cured	1	4	4	0	2.52	--	--	--	--	--	--	
	0	0	0	0	--	--	--					

County and Kind of Samples	Number of Farms Sampled	Number of Samples		Average Percent* Alkaloids		D V A V Ratio	Average Percent* Nitrogen		Ratio N/Alkaloids	
		D V	A V	D V	A V		D V	A V	D V	A V
Onslow:										
Green Cured	1 4	8 4	0 2	1.51 1.50	3.03	0.49	1.41	1.53	0.94	0.51
Orange:										
Green Cured	1 0	10 0	4 0	1.56 --	2.84 --	.55 --	--	--	--	--
Pender:										
Green Cured	1 0	12 0	4 0	1.66 --	2.37 --	.70 --	--	--	--	--
Person:										
Green Cured	5 4	33 6	16 1	1.72 1.27	3.11 2.84	.55 .45	2.01	2.13	1.28	.75
Pitt:										
Green Cured	90 59	617 136	452 88	2.48 2.76	3.94 3.38	.63 .82	2.29	2.18	.83	.65
Randolph:										
Green Cured	3 0	12 0	4 0	2.26 --	3.03 --	.74 --	--	--	--	--
Robeson:										
Green Cured	1 0	4 0	2 0	1.17 --	1.52 --	.77 --	--	--	--	--
Rockingham:										
Green Cured	48 35	172 45	147 18	1.97 1.92	2.97 2.74	.66 .69	2.13 1.82	2.13 1.88	1.07 .95	.71 .69
Sampson:										
Green Cured	19 5	98 9	79 5	1.73 1.69	3.40 2.84	.51 .60	1.80	2.05	1.07	.72
Stokes:										
Green Cured	13 17	112 30	92 8	1.99 1.82	2.28 2.62	.88 .68	1.91	2.11	1.05	.74

County and Kind of Samples	Number of Farms Sampled	Number of Samples	Number of Samples		Average Percent*		D V Ratio	Average Percent*		D V Ratio	Average Percent*		D V Ratio	Ratio N/Alkaloids	
			D V	A V	D V	A V		D V	A V		D V	A V		D V	A V
Surry:															
Green Cured	10	82	58	24	1.30	2.44	0.53	1.53	2.06	1.26	0.73				
Vance:	5	6	3	3	1.21	2.82	.43								
Green Cured	12	61	45	16	2.09	4.75	0.44								
Make:	2	3	0	3	--	3.26	--								
Green Cured	14	98	81	17	2.14	3.27	.65								
Warren:	21	33	11	22	2.11	3.33	.64								
Green Cured	10	60	36	24	2.46	4.44	.55	2.16	2.20	1.02	.66				
Washington:	2	2	0	2	--	5.27	--								
Green Cured	3	25	19	6	2.30	3.82	.63								
Wayne:	0	0	0	0	--	--	--								
Green Cured	33	171	131	40	1.89	3.37	.56								
Wilson:	23	40	21	19	1.98	3.02	.65								
Green Cured	13	58	38	20	2.34	3.27	.72	1.90	2.09	.96	.69				
Yadkin:	7	18	9	9	2.43	3.00	.81								
Green Cured	34	189	155	34	1.83	2.14	.86	1.98	2.18	.82	.72				
Green Cured	29	30	11	19	1.89	2.96	.84								
Total & Average															
Green Cured	792	4,667	3,338	1,329	1.94	3.13	.62	1.96	2.02	1.04	.68				
	530	975	499	476	2.12	3.03	.70								
								2.43	2.02	1.25	.65				
								1.96	2.06	.93	.67				

* 65° C. "dry" basis.

* 65° C. "dry" basis.

Table 16. Comparison of variety-identification specialist classification of flue-cured tobacco and percent alkaloids, nitrogen, and ratio of nitrogen to alkaloids, 1957 Virginia farm crop.

County and Kind of Samples	Number of Farms Sampled	Number of Samples	Number of Samples		Average Percent*		D V		Average Percent*		D V		Ratio		M/Alkaloids	
			D	V	A	V	D	V	A	V	D	V	Ratio	D V	A V	A V
Brunswick:																
Green Cured	9	68	41	27												
Charlotte	2	4	2	2												
Green Cured	7	50	30	20												
Greensville:	4	10	3	7												
Green Cured	1	4	0	4												
Halifax:	0	0	0	0												
Green Cured	22	164	93	71												
Lunenburg:	9	35	14	21												
Green Cured	6	265	150	115												
Mecklenburg:	0	0	0	0												
Green Cured	14	155	87	68												
Pittsylvania:	7	14	8	6												
Green Cured	24	110	73	37												
Total & Average:	12	25	12	13												
Green Cured	83	816	474	342												
Green Cured	34	88	39	49												

* 65° C. "dry" basis.

Table 17. Cured-leaf flue-cured tobacco comparisons of percent alkaloids, percent nitrogen, and ratios of nitrogen to alkaloids, 1957 farm crop of 5 States.

State	Total Number of Samples	Number of Samples		Average Percent* Alkaloids		D V A V Ratio		Average Percent* Nitrogen		Ratio N/Alkaloids	
		D V	A V	D V	A V	D V	A V	D V	A V	D V	A V
Florida	0	0	0	---	---	---	---	---	---	---	---
Georgia	7	7	0	1.04	---	---	---	1.43	---	1.38	---
South Carolina	39	24	15	1.59	2.41	0.66	1.71	1.84	1.08	0.76	
North Carolina	975	499	476	2.12	3.03	.70	1.96	2.06	.93	.67	
Virginia	88	39	49	2.40	3.31	.72	2.03	2.03	.86	.63	
Total & Average	1,109	569	540	2.10	3.04	.70	1.95	2.05	.93	.67	

* 65° C. "dry" basis.

Table 18. Differences in percent alkaloids, percent nitrogen and nitrogen/alkaloids ratios for green and cured leaves of A V and D V flue-cured tobacco, 1957 farm and experimental crops of 5 States.

State and Kind of Crop	Number of Samples		Difference in % Alkaloids (AV-DV)		Difference in % Nitrogen (AV-DV)		Difference in Ratios (AV-DV)	
	Green	Cured	Green	Cured	Green	Cured	Green	Cured
Florida: Farm Experimental	102 260	-- 34	0.85 .52	-- 0.38	-- --	-- 0.10	-- --	-- 0.67
Georgia: Farm Experimental	59 40	7 16	.65 .99	-- .92	-- --	-- .02	-- --	-- .82
South Carolina: Farm Experimental	546 125	39 --	1.35 .70	.82 --	0.09 --	.13 --	0.90 --	.32 --
North Carolina: Farm Experimental	4,667 648	975 195	1.19 1.34	.91 1.01	.41 --	.10 --	.60 --	.26 --
Virginia: Farm Experimental	816 28	88 10	1.18 .88	.91 .50	-- --	.08 .43	.38 --	.23 .30
Totals & Averages Farm Experimental	6,190 1,101	1,109 255	1.19 1.05	.91 .90	.35 --	.09 .43	.54 --	.26 .65
All	7,291	1,364	1.17	.91	.35	.10	.54	.28

Table 19. Comparison of classification of flue-cured tobacco and percent alkaloids, nitrogen, and ratio of nitrogen to alkaloids, 1957 farm crop.

(Green tobacco classified by variety-identification specialist, cured classified by analysis)

State	Type of Sample	Number of Farms Sampled	Number of Samples	Number of Samples		Average Percent* Alkaloids		Average Percent* Nitrogen		Ratio		Ratio N/Alkaloids	
				D	V	D	V	D	V	D	V	D	V
Fla.	Green Cured	27	102	51	51	0.75	1.60	0.46	--	--	--	--	--
				--	--	--	--	--	--	--	--	--	--
Ga.	Green Cured	11	59	45	14	1.09	1.74	.63	--	--	--	--	--
				7	0	1.04	--	--	1.43	--	--	1.38	--
S. C.	Green Cured	89	546	364	182	1.34	2.67	.50	2.33	2.24	2.24	1.74	0.84
				24	15	1.59	2.41	.66	1.71	1.84	1.84	1.08	.76
N. C.	Green Cured	792	4,667	3,338	1,329	1.94	3.13	.62	2.43	2.02	2.02	1.25	.65
				499	476	2.12	3.03	.70	1.96	2.06	2.06	.93	.67
Va.	Green Cured	83	816	474	342	2.25	3.44	.65	2.43	2.43	2.43	1.08	.70
				39	49	2.40	3.31	.72	2.03	2.11	2.11	.86	.63

* 65° C. "dry" basis.

Table 20. Comparison of percent alkaloids in green-leaf tobacco by flue-cured types, 1957 experimental crop.

Type	Number of Locations	Number of Samples	Number of Samples		Average Percent* Alkaloids		D V Ratio
			D V	A V	D V	A V	
I1a	13	113	38	75	1.60	2.48	.64
I1b	18	300	66	234	1.50	2.88	.52
I2	14	162	43	119	1.65	3.28	.50
I3	18	226	74	152	1.08	2.04	.52
I4	2	300	108	192	.85	1.60	.53

* 65° C. "dry" basis.

Table 21. Comparison of classification of flue-cured tobacco and percent alkaloids, percent nitrogen, and ratio of nitrogen to alkaloids by flue-cured types (belts), 1957 farm crop.

(Green tobacco classified by variety-identification specialists, cured classified by analysis)

Type	Number of Farms Sampled	Number of Samples		Average Percent* Alkaloids		Average Percent* Nitrogen		Ratio N/Alkaloids	
		D V	A V	D V	A V	D V	A V	D V	A V
11a Green	228	1,064	428	1.98	3.17	0.62	2.34	1.18	0.78
11a Cured	168	99	151	2.02	3.08	.66	1.91	.95	.67
11b Green	188	698	516	2.10	3.48	.60	--	--	--
11b Cured	137	120	156	1.99	3.06	.65	1.90	.96	.67
12 Green	441	1,959	693	2.01	3.11	.65	2.64	1.31	.66
12 Cured	250	313	210	2.23	3.21	.69	2.01	.91	.64
13 Green	107	455	216	1.34	2.61	.51	2.36	1.76	.84
13 Cured	31	30	23	1.60	2.30	.70	1.75	1.10	.76
14 Green	38	96	65	.91	1.63	.56	--	--	--
14 Cured	7	7	0	1.04	--	--	1.43	1.38	--

* 65° C. "dry" basis.

Redrying Plant Samples

A total of 5,604 cured leaf samples were obtained from redrying plants throughout the flue-cured tobacco area. The grader was instructed to set aside at random a minimum of 50 baskets per day including all "LL" grades. These baskets were sampled by an employee of the redrying plant.

A sample consisted of 20 to 30 leaves, taken 1 leaf per hand from 20 to 30 hands and tied into a sample hand. These samples were taken by grades and types. The sample hands were received at the Raleigh office and prepared for analysis as described in the cured-leaf sampling procedure.

Percent total alkaloids were determined for all samples. Approximately 15 percent of the samples were also analyzed for total nitrogen content.

A summary of the analyses of redrying plant samples by types and grade groups is presented in Table 22. The

Table 22. Analysis of redrying plant samples of flue-cured tobacco by type and grade groups, 1957 farm crop.

Group	Total Samples		Samples Analyzed for Nitrogen			
	Number	Average Percent* Alkaloids	Number	Average Percent* Alkaloids	Average Percent* Nitrogen	Ratio N/Alkaloids
TYPE 11a						
Wrappers A	1	2.98	0	--	--	--
Leaf B	302	3.47	65	3.52	2.33	0.66
Smoking Leaf H	34	3.89	7	4.12	2.65	.64
Cutters C	5	3.59	0	--	--	--
Lugs X	29	3.35	5	3.76	2.22	.59
Primings P	8	2.86	3	2.48	1.77	.71
Nondescript N	19	4.11	0	--	--	--
Totals & Averages	398	3.52	80	3.55	2.33	0.66
TYPE 11b						
Wrappers A	0	--	--	--	--	--
Leaf B	407	3.23	34	2.34	1.86	0.79
Smoking Leaf H	32	3.46	2	2.47	1.82	.74
Cutters C	75	2.31	18	1.87	1.67	.89
Lugs X	153	2.71	19	2.32	1.88	.81
Primings P	61	2.57	9	1.87	1.71	.91
Nondescript N	23	3.31	0	--	--	--
Totals & Averages	751	3.00	82	2.18	1.80	0.83

Group	Total Samples		Samples Analyzed for Nitrogen			
	Number	Average Percent* Alkaloids	Number	Average Percent* Alkaloids	Average Percent* Nitrogen	Ratio N/Alkaloids
TYPE 12						
Wrappers A	2	2.66	0	--	--	--
Leaf B	1,553	3.28	221	3.22	2.12	0.66
Smoking Leaf H	39	3.01	7	2.53	2.30	.91
Cutters C	584	2.01	27	1.94	1.61	.83
Lugs X	313	2.54	30	2.66	1.97	.74
Primings P	47	2.12	7	2.28	1.93	.85
Nondescript N	59	3.44	15	3.62	2.62	.72
Totals & Averages	2,597	2.88	307	3.04	2.08	0.68
TYPE 13						
Wrappers A	0	--	0	--	--	--
Leaf B	559	1.83	35	1.83	1.66	0.91
Smoking Leaf H	19	1.86	1	2.16	1.72	.80
Cutters C	542	1.30	71	1.42	1.48	1.04
Lugs X	334	1.32	77	1.52	1.62	1.07
Primings P	105	1.44	13	1.90	1.81	.95
Nondescript N	30	1.90	5	1.30	2.02	1.55
Totals & Averages	1,589	1.52	202	1.56	1.60	1.03
TYPE 14						
Wrappers A	0	--	0	--	--	--
Leaf B	94	1.54	60	1.47	1.57	1.07
Smoking Leaf H	1	2.14	1	2.14	2.44	1.14
Cutters C	52	1.52	35	1.46	1.62	1.11
Lugs X	99	1.33	80	1.26	1.55	1.23
Primings P	20	1.46	17	1.52	1.80	1.18
Nondescript N	3	1.55	2	1.41	2.61	1.85
Totals & Averages	269	1.46	195	1.39	1.61	1.16
ALL TYPES						
Wrappers A	3	2.77	0	--	--	--
Leaf B	2,915	2.96	415	2.82	2.01	0.71
Smoking Leaf H	125	3.18	18	3.10	2.36	.76
Cutters C	1,258	1.71	151	1.58	1.56	.99
Lugs X	928	2.10	211	1.71	1.68	.98
Primings P	241	1.91	49	1.85	1.80	.97
Nondescript N	134	3.13	22	2.89	2.48	.86
Total & Averages	5,604	2.50	866	2.29	1.85	0.81

* 65° C. "dry" basis.

average percent total alkaloids for all groups increased from 1.46 for type 14 to 3.52 percent for type 11a. The overall average percent total alkaloids for 5,604 redrying plant samples was 2.50. The 15 percent, or 866 samples, that were analyzed for nitrogen contained 2.99 percent total alkaloids and 1.85 percent total nitrogen.

The area of production of the redryer samples was not known with certainty as was the case with the farm and experimental green- and cured-leaf samples. However, the data are in agreement with respect to type or area consideration.

DISCUSSION

The results obtained in this study indicate that there is a fundamental difference in the total alkaloid content of the discount and acceptable varieties. The absolute alkaloid levels of the acceptable and discount varieties were found to vary widely with the location from which the samples were obtained; but, when grown under similar conditions, the acceptable varieties were found to have a much higher alkaloid level than did the discount varieties.

Although the alkaloid level of the discount varieties grown under conditions of high fertility might, in some cases, exceed that of acceptable varieties grown at the same location under conditions of low fertility, the discount varieties could still be distinguished on the basis of the total nitrogen to total alkaloids ratio. When grown under exactly the same conditions, for example in mixed plantings, the acceptable and discount varieties could be distinguished reliably by total alkaloid determinations alone.

The seemingly abnormal difference in general alkaloid level noted in the study of samples obtained from various locations in the flue-cured belt could be largely attributed to the weather conditions which prevailed. Thus, very low alkaloid values were obtained in the Florida and Georgia samples of tobacco grown under conditions of excessive rainfall. Much higher values were obtained in Virginia, where the weather conditions were much drier, and intermediate values were obtained in South and North Carolina. Variations in results at several locations within a State could also be attributed to variations in weather conditions which prevailed at the different locations.

It is interesting to note that the acceptable varieties grown under conditions of excess rainfall had a lower alkaloid content than did the discount varieties grown under dry weather conditions. The discount varieties grown under the driest conditions (in Virginia) were found to have an average alkaloid content of 2.25 percent, which very closely approached the traditional average alkaloid value for flue-cured tobacco. This may partially explain their acceptance by the trade during the dry weather conditions which prevailed during their development. The data obtained would indicate, however, that the alkaloid level of the discount varieties would be too low under more optimum growing conditions and this may be related to their poor acceptance by the trade during 1955 and 1956.

SUMMARY

1. On December 18, 1956, The United States Department of Agriculture announced that the 1957 crop of flue-cured tobacco of varieties Coker 139, Coker 140, and Dixie Bright 244, irrespective of grade, would be supported at one-half the support rates for comparable grades of other varieties. These three varieties had been previously classified by the Trade, Federal and State scientists of the flue-cured tobacco area as "low to lacking in flavor and aroma, generally of light body, and..... [poorly accepted] in the trade."
2. The discount program was based on field identification of the discount varieties by specialists and subsequent chemical analysis of samples taken by the specialists for an independent check on the accuracy of identification.
3. Sampling and analytical procedures developed at the Kentucky Agricultural Experiment Station are described, and the results of tests made on known varieties grown under different conditions throughout the flue-cured area are given.
4. The results obtained confirmed initial work by the North Carolina Agricultural Experiment Station, which had shown that varieties of flue-cured tobacco tend to maintain their relative rankings with relationship to total alkaloids in different areas and under different conditions.

5. A total of 1,101 green-leaf samples of known varieties was collected by ASC variety specialists from tobacco growing on State Experiment Stations and State ASC plots, and these samples were submitted for chemical analysis. The average total alkaloid percent for the 3 discount varieties was 1.17 as compared to 2.27 percent for all other varieties. This reflects a difference of 1.10 percent with a D V/A V ratio of 0.52.
6. At 48 locations in North Carolina the average total alkaloid percent for the 3 discount varieties was 1.46 as compared to 2.70 percent for 10 other varieties. The resulting difference of 1.24 percent and a D V/A V ratio of 0.54 compared favorably with the total experimental sampling results through the flue-cured area.
7. A total of 6,190 green-leaf samples was taken from producer fields. The samples designated by variety identification specialists as being discount-variety tobacco had an average percent total alkaloid content of 1.90 as compared to 3.09 percent for samples of non-discount varieties. The difference of 1.19 and D V/A V ratio of 0.61 is in agreement with the results of all experimental samplings.
8. A total of 1,109 cured-leaf samples was collected from producer farms. The percent total alkaloids for the discount variety tobacco 2.10 as compared to 3.04 percent for all other varieties. The percent total nitrogen was 1.95 versus 2.05, which gives a ratio of nitrogen to alkaloids of 0.93 for discount varieties versus 0.67 for other varieties. Although nitrogen and alkaloid contents vary markedly with fertilization, the total nitrogen and alkaloid contents are affected similarly by fertilization so that the ratio remains fairly constant and is therefore a good means for comparing varieties where comparisons are necessary between plants grown in the same locality but under different fertility levels.
9. Based on green-leaf samples the A V - D V difference was 1.17 percent for alkaloids and 0.35 percent for nitrogen. This resulted in an A V - D V difference between the average nitrogen to alkaloid ratios of 0.54.
10. Based on 1,364 cured-leaf samples, the A V - D V difference was 0.91 percent for alkaloids and 0.10 percent

for nitrogen. This reflects an average ratio difference of 0.28.

11. Cured-leaf samples were obtained from redrying plants located throughout the flue-cured tobacco area. The average percent total alkaloid for 5,604 of those samples was 2.50. Total nitrogen content for 866 of those samples was 1.85 percent and total alkaloid was 2.29 percent, resulting in a ratio of 0.81. These results are presented by type and grade groups.
12. The results give further evidence that varieties of flue-cured tobacco maintain their relative rankings with respect to total alkaloid content regardless of environment or area. The data also show that the nitrogen content varies less with variety, environment, or area than the alkaloid content and that a ratio of nitrogen to alkaloids gives a good index for comparison. These interpretations apply to data obtained from samplings of both green and cured leaves.

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